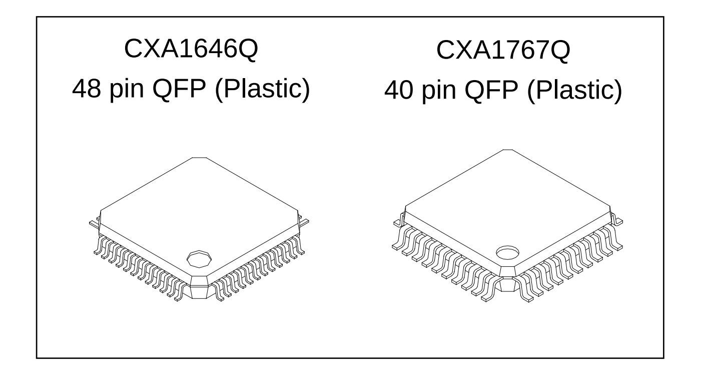
SONY

CXA1646Q/CXA1767Q

Electronic Volume



Description

The CXA1646Q/CXA1767Q is a serial control electronic volume IC for car stereos.

Features

- Loudness
- Volume control
  (1dB-step from 0dB to –87dB, –∞dB)
- Balance
- Tone control
  (2dB-step 2 band from –14dB to +14dB)
- Fader
  (2dB-step to –20dB, –25dB, –35dB, –45dB, –60dB, –∞dB)
- Input selector (4 channels)
- Serial data control (DATA, CLK, CE)
- Single 8V power supply
- Zero-cross detection circuit

Structure

Bipolar IC

Absolute Maximum Ratings (Ta = 25°C)

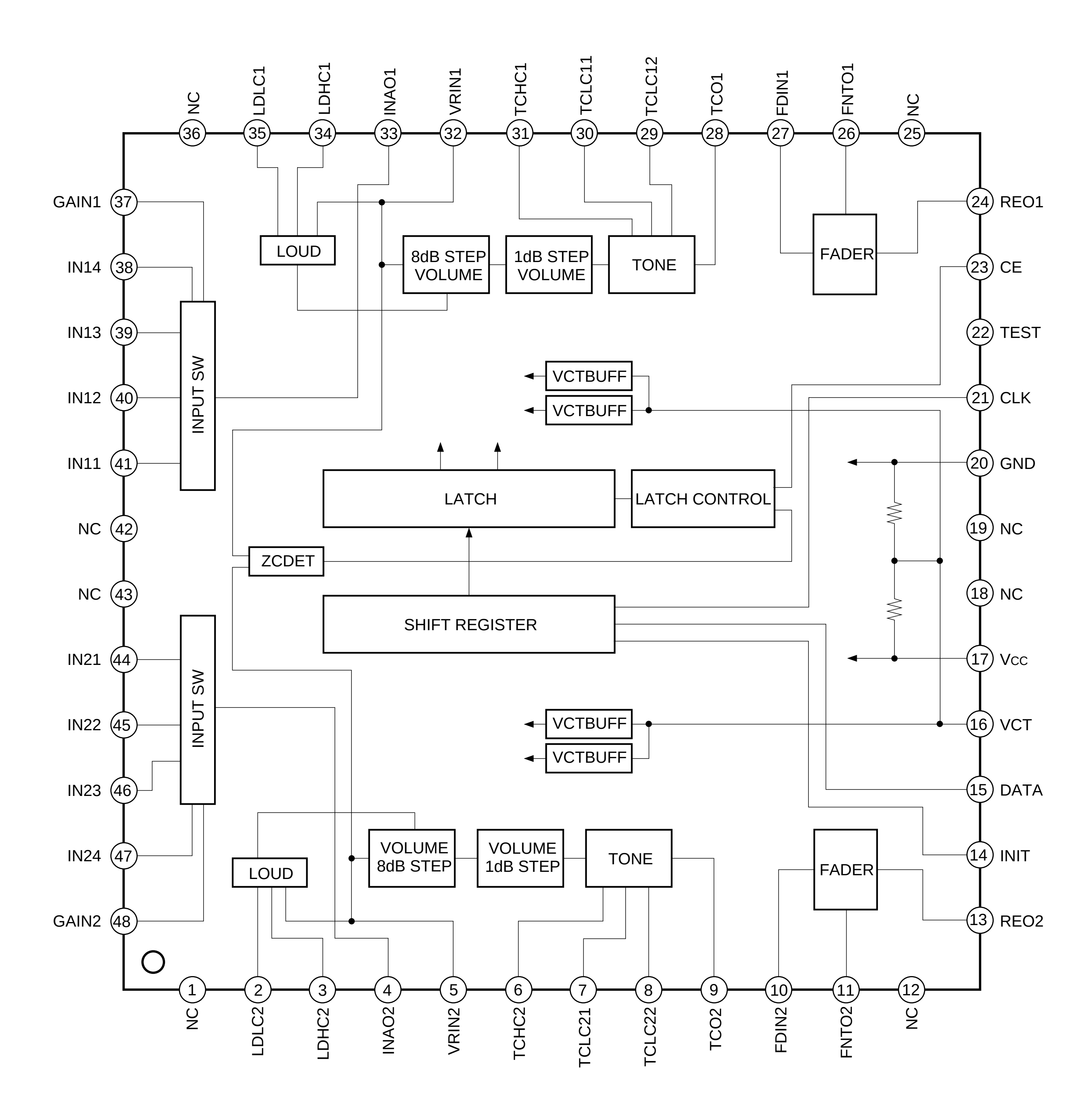
• Supply voltage	V_{CC}	13	V	
• Operating temperature	Topr	–40 to +85	°C	
• Storage temperature	Tstg	–65 to +150	°C	
• Allowable power dissipation	P_D	350	mW	(Ta = 85°C, 1646Q)
		240	mW	(Ta = 85°C, 1767Q)

Recommended Operating Condition

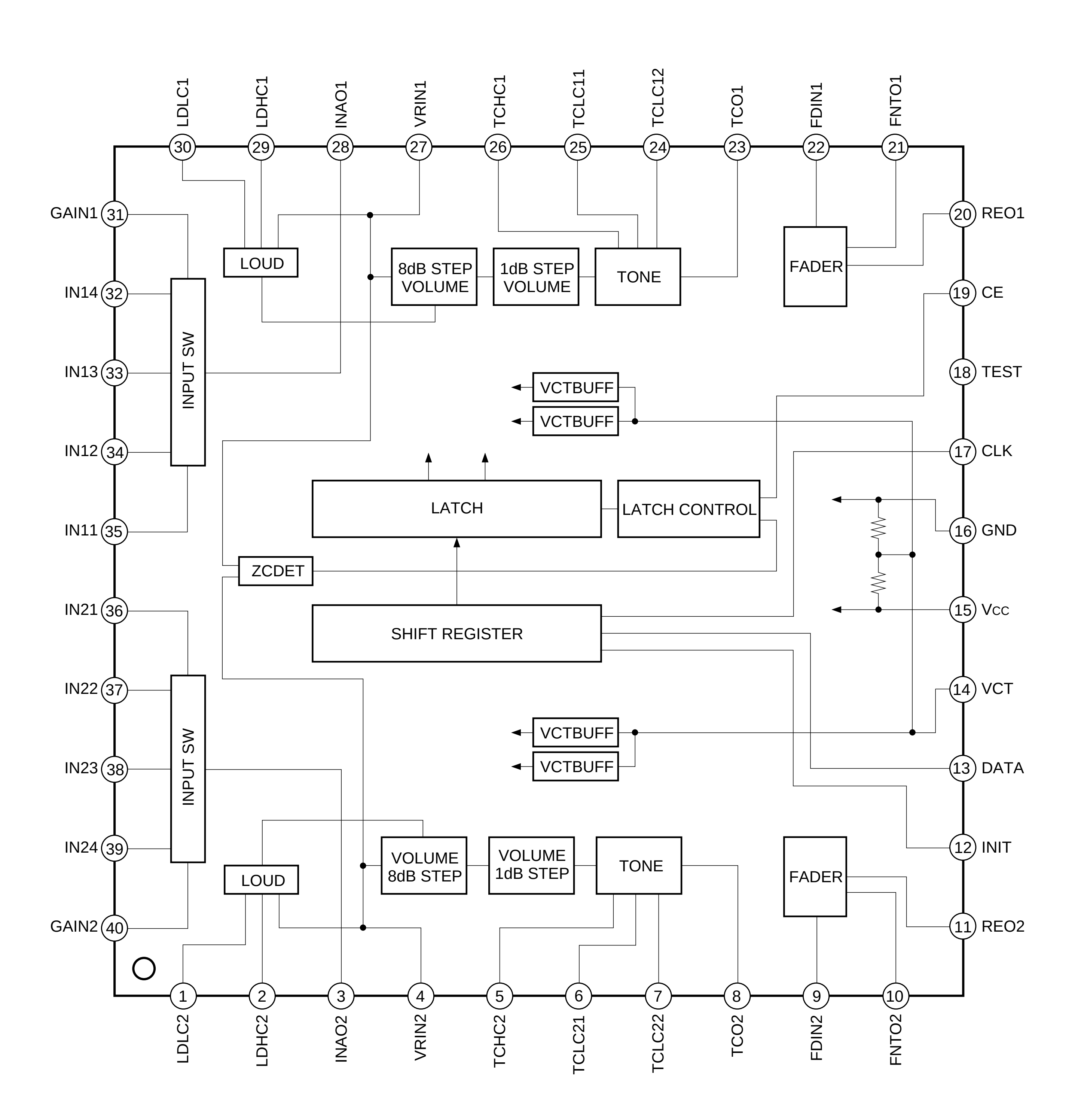
Supply voltage	V_{CC}	6 to 12	V

Block Diagram and Pin Configuration

CXA1646Q



CXA1767Q


LDLC1
LDHC1
INAO1
VRIN1
TCHC1
TCLC11
TCLC12
TCO1
FDIN1
FNTO1
30
29
28
27
26
25
24
23
22
21
GAIN1 31
IN14 32
IN13 33
IN12 34
IN11 35
IN21 36
IN22 37
IN23 38
IN24 39
GAIN2 40
20 REO1
19 CE
18 TEST
17 CLK
16 GND
15 Vcc
14 VCT
13 DATA
12 INIT
11 REO2
LOUD
8dB STEP VOLUME
1dB STEP VOLUME
TONE
FADER
INPUT SW
VCTBUFF
VCTBUFF
LATCH
LATCH CONTROL
ZCDET
SHIFT REGISTER
VCTBUFF
VCTBUFF
INPUT SW
LOUD
VOLUME 8dB STEP
VOLUME 1dB STEP
TONE
FADER
1
2
3
4
5
6
7
8
9
10
LDLC2
LDHC2
INAO2
VRIN2
TCHC2
TCLC21
TCLC22
TCO2
FDIN2
FNTO2

Pin Description (Pin No. in the parenthesis is for CXA1767Q.)

Pin No.	Symbol	I/O resistance Pin voltage	Equivalent circuit	Description
2 (1) 35 (30)	LDLC2 LDLC1	5.28kΩ VCT	Vcc GND	Sets loudness low cut-off frequency.
3 (2) 34 (29)	LDHC2 LDHC1	7.97kΩ VCT	Vcc GND	Sets loudness high cut-off frequency.
4 (3) 33 (28)	INAO2 INAO1	— VCT	Vcc GND	Input selector output
5 (4) 32 (27)	VRIN2 VRIN1	50kΩ VCT	Vcc GND	Volume input

Pin No.	Symbol	I/O resistance Pin voltage	Equivalent circuit	Description
6 (5) 31 (26)	TCHC2 TCHC1	5kΩ VCT	Vcc GND	Sets tone high frequency.
7 (6) 30 (25)	TCLC21 TCLC11	8kΩ VCT	Vcc GND	Sets tone low frequency.
8 (7) 29 (24)	TCLC22 TCLC12	8kΩ VCT	Vcc GND	Sets tone low frequency.
9 (8) 28 (23)	TCO2 TCO1	— VCT	Vcc GND	Tone control output

Pin No.	Symbol	I/O resistance Pin voltage	Equivalent circuit	Description
10 (9) 27 (22)	FDIN2 FDIN1	24kΩ VCT	Vcc GND	Fader input
11 (10) 26 (21)	FNTO2 FNTO1	— VCT	Vcc GND	Front output
13 (11) 24 (20)	REO2 REO1	— VCT	Vcc GND	Rear output
14 (12)	INIT	— —	Vcc GND	System reset

Pin No.	Symbol	I/O resistance Pin voltage	Equivalent circuit	Description
15 (13)	DATA	≃ ∞ —	Vcc GND	Serial data input
16 (14)	VCT	— VCT		$\frac{1}{2}$ Vcc
17 (15)	Vcc	Vcc		+power supply
20 (16)	GND	GND		GND
21 (17)	CLK	≃ ∞ —	Vcc GND	Serial clock
22 (18)	TEST	— —		Test. Leave open.
23 (19)	CE	≃ ∞ —	Vcc GND	Latch enable

Pin No.	Symbol	I/O resistance Pin voltage	Equivalent circuit	Description
37 (31) 48 (40)	GAIN1 GAIN2	10kΩ VCT		Sets input amplifier gain to 6dB by connecting to VCT. 0dB at open.
38 (32) 39 (33) 40 (34) 41 (35) 44 (36) 45 (37) 46 (38) 47 (39)	IN14 IN13 IN12 IN11 IN21 IN22 IN23 IN24	50kΩ VCT		Signal input

Reset

Reset is performed by lowering the INIT pin below 1V when CLK is High. Reset is disabled when CLK is Low.
The following table shows the reset status.

Mode	Set value
INPUT	1
VRC1	–∞
VRF1	–7dB
VRC2	–∞
VRF2	–7dB
LOUD	OFF
TONE BASS	0dB
TONE TREBLE	0dB
FADER	0dB, REAR

Data Format

(a) Data allocation

	Bits	Data	
FAST BIT	D1 D2	NOP	MSB
	D3 D4	ISW	
	D5	LOUD	
	D6 D7 D8 D9	VRC1	
	D10 D11 D12	VRF1	
	D13 D14 D15 D16	VRC2	
	D17 D18 D19	VRF2	
	D20 D21 D22 D23	TONE BASS	
	D24 D25 D26 D27	TONE TREBLE	
	D28 D29 D30 D31	FADER	
LAST BIT	D32	FADER SELECT	LSB

(b) Set table

• NOP

Set value	D1	D2
—	0	0

• ISW

Set value	D1	D2
IN14/IN24	1	1
IN13/IN23	1	0
IN12/IN22	0	1
IN11/IN21	0	0

• LOUD

Set value	D5
ON	1
OFF	0

• VRC1/VRC2

Set value	D6/D13	D7/D14	D8/D15	D9/D16
O	1	1	1	1
–8	1	1	1	0
–16	1	1	0	1
–24	1	1	0	0
–32	1	0	1	1
–40	1	0	1	0
–48	1	0	0	1
–56	1	0	0	0
–64	0	1	1	1
–72	0	1	1	0
–80	0	1	0	1
–∞	0	1	0	0
–∞	0	0	0	0

• VRF1/VRF2

Set value	D10/D17	D11/D18	D12/D19
O	1	1	1
–1	1	1	0
–2	1	0	1
–3	1	0	0
–4	0	1	1
–5	0	1	0
–6	0	0	1
–7	0	0	0

• TONE BASS/TREBLE

Set value	D20/D24	D21/D25	D22/D26
14	1	1	1
12	1	1	0
10	1	0	1
8	1	0	0
6	0	1	1
4	0	1	0
2	0	0	1
0	0	0	0

• BOOST/CUT

Set value	D23/D27
BOOST	1
CUT	0

• FADER

Set value	D28	D29	D30	D31
–∞	1	1	1	1
–60	1	1	1	0
–45	1	1	0	1
–35	1	1	0	0
–25	1	0	1	1
–20	1	0	1	0
–18	1	0	0	1
–16	1	0	0	0
–14	0	1	1	1
–12	0	1	1	0
–10	0	1	0	1
–8	0	1	0	0
–6	0	0	1	1
–4	0	0	1	0
–2	0	0	0	1
0	0	0	0	0

• FADER SELECT

Set value	D32
Attenuation of front signal	1
Attenuation of rear signal	0

• **DATA TIMING**

CE

DATA

D1

D2

D3

D31

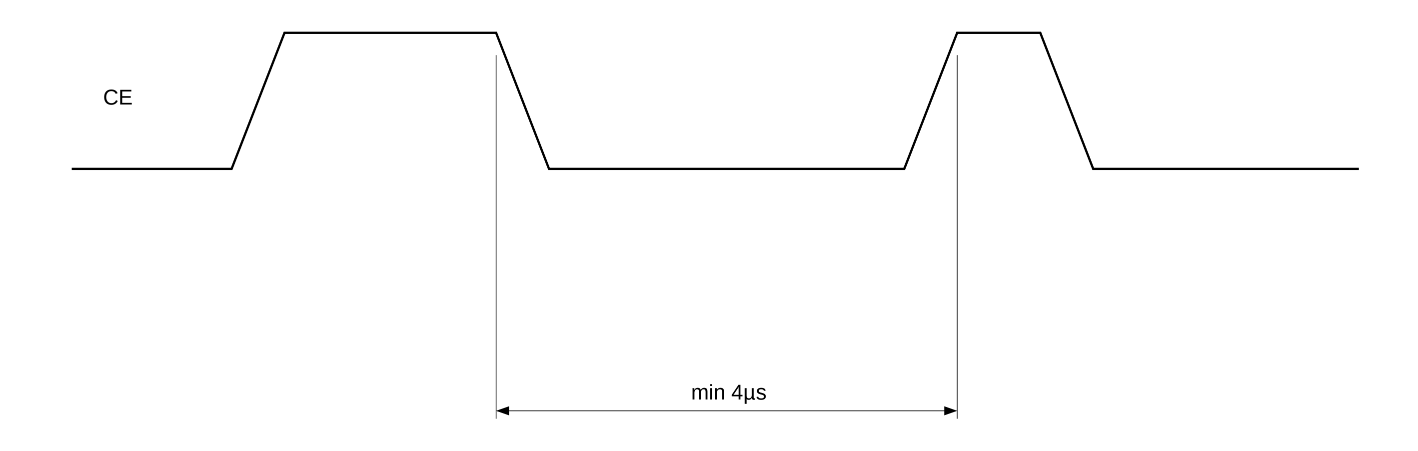
D32

CLK

min 0.5µs

max 1MHz

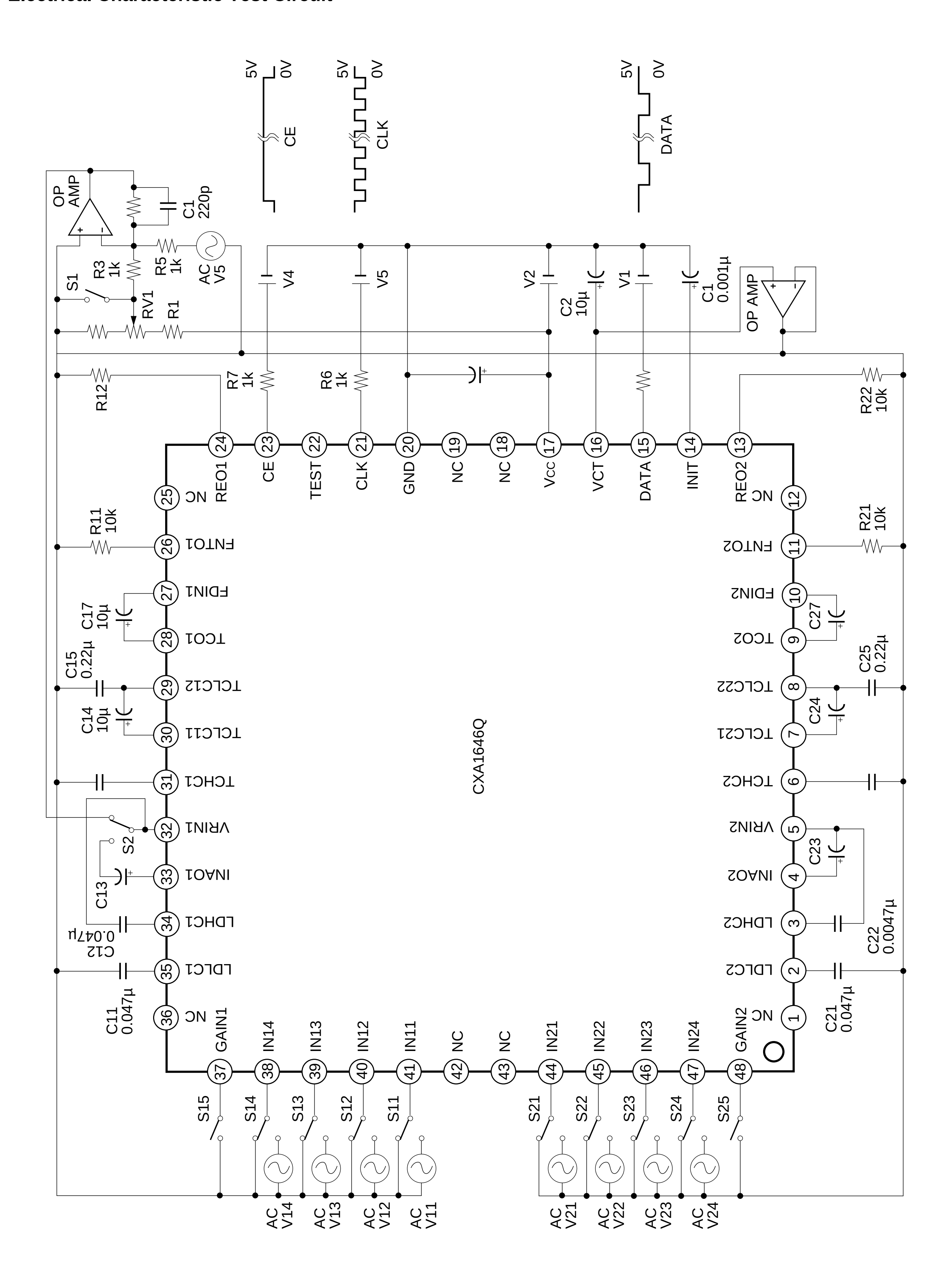
min 0.5µs



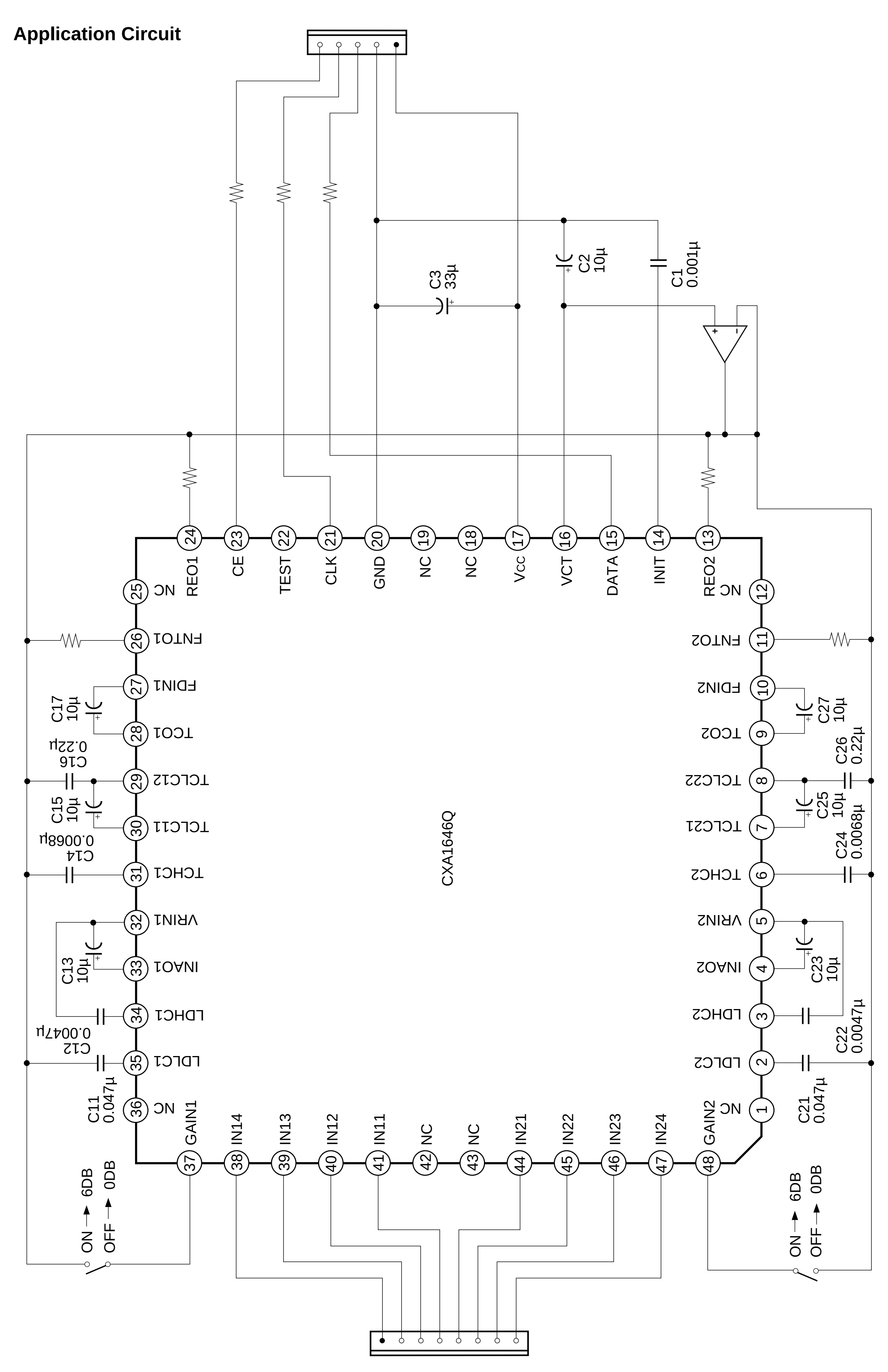
Electrical Characteristics (VCC = 8V, Ta = 25°C unless otherwise specified)

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit
Circuit current		ICC	No signal	—	17	21	mA
Total harmonic distortion factor		THD	1kHz, 5dBm	—	0.005	0.01	%
Output noise voltage		Vn	Shortcircuit at input, Aweight	—	7	10	µVrms
Maximum output voltage		Vom	1kHz	8	—	—	dBm
Separation		CS	1kHz	72	90	—	dB
Maximum attenuation factor		ATTm		85	90	—	dB
Loudness	LOW	Glb	100Hz, VRC = –16dB	7	8	9	dB
	HIGH	Glh	10kHz, VRC = –16dB	7	8	9	dB
Bass boost gain		Gbb	100Hz	12	14	16	dB
Bass cut gain		Gbc	100Hz	12	14	16	dB
Treble boost gain		Gtb	10kHz	12	14	16	dB
Treble cut gain		Gtc	10kHz	12	14	16	dB
Gain switching		Gh	GAIN = VCT	5	6	7	dB
Input voltage	H	Vsh	DATA, INIT CLK, CE	3	—	6	V
	L	Vsl		0	—	1.5	V
Input voltage range		Vin	IN11 to 14 IN21 to 24 VRIN1, 2 FDIN1, 2	1	—	VCC – 1	V

Electrical Characteristic Test Circuit

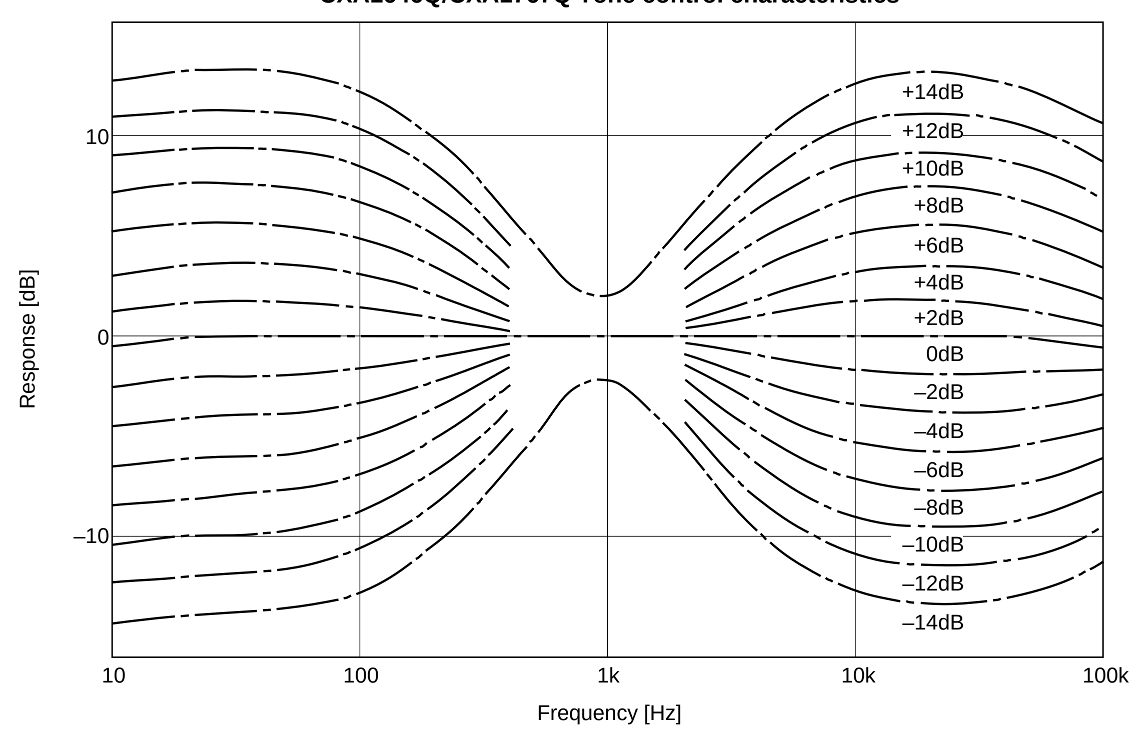


Application Circuit

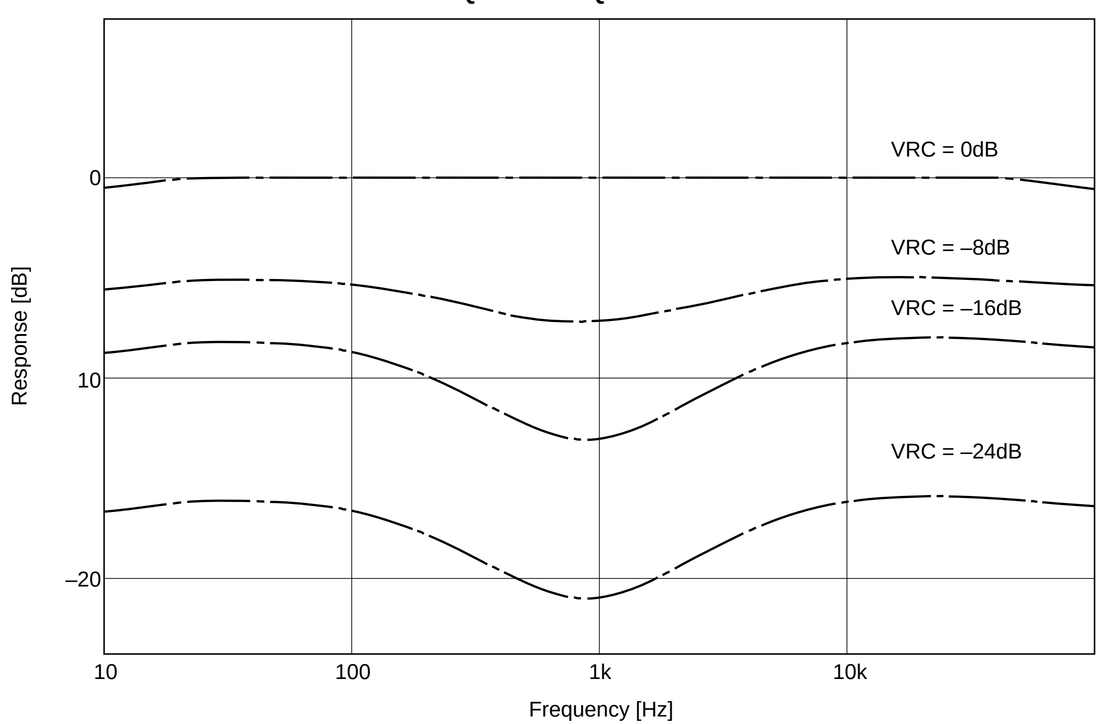


Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

CXA1646Q/CXA1767Q Tone control characteristics



CXA1646Q/CXA1767Q Loud characteristics



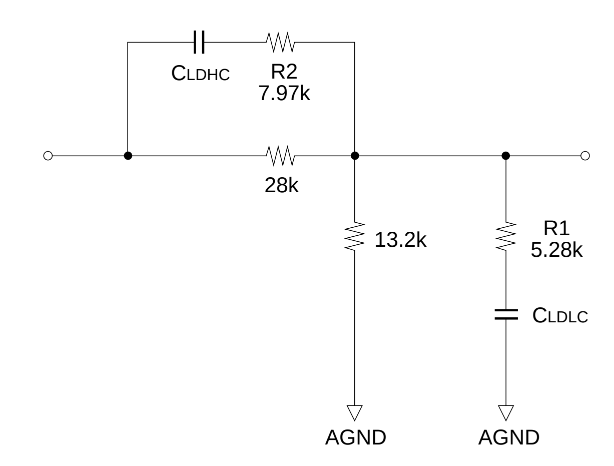
Setting Constants

• **LOUD**

The loudness function achieves the necessary frequency characteristics by passing through filter shown below. The resistor is built in the IC so that f_L and f_H are set by selecting C_{LDLC} and C_{LDHC}.

$I/f_L = 2\pi \quad C_{LDLC}R_1$

$I/f_H = 2\pi \quad C_{LDHC}R_2$





• TONE CONTROL

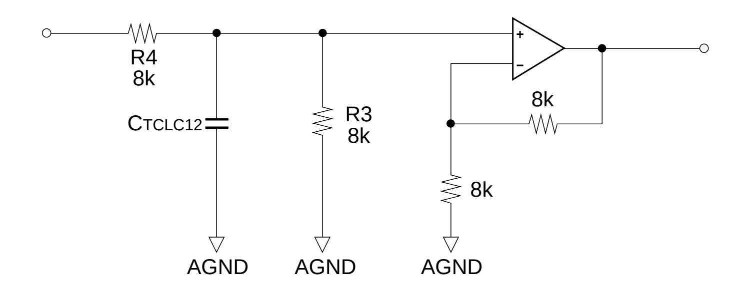
The tone control function achieves the necessary frequency characteristics by passing through LPF and HPF shown below.

The resistor is built in the IC so that f_L and f_H are set by selecting C_{TLC12} and C_{TCHC}.

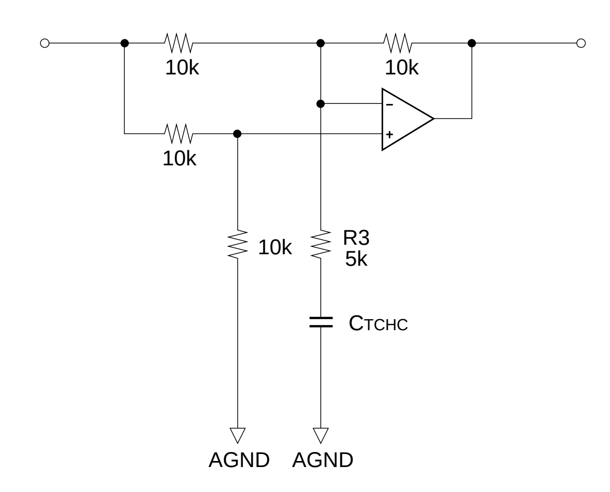
$I/f_L = 2\pi \quad C_{TCLC12} (R_3//R_4)$

$I/f_H = 2\pi \quad C_{TCHC}R_3$

LPF



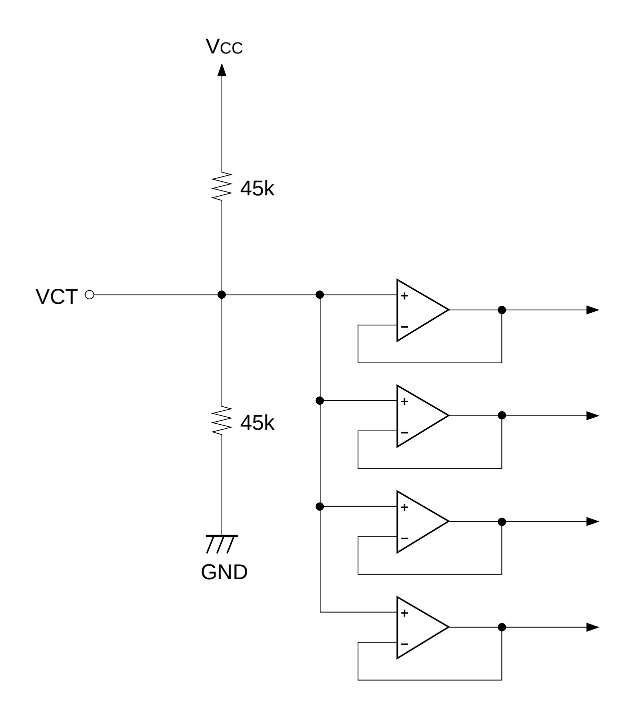
HPF





• **VCT pin**

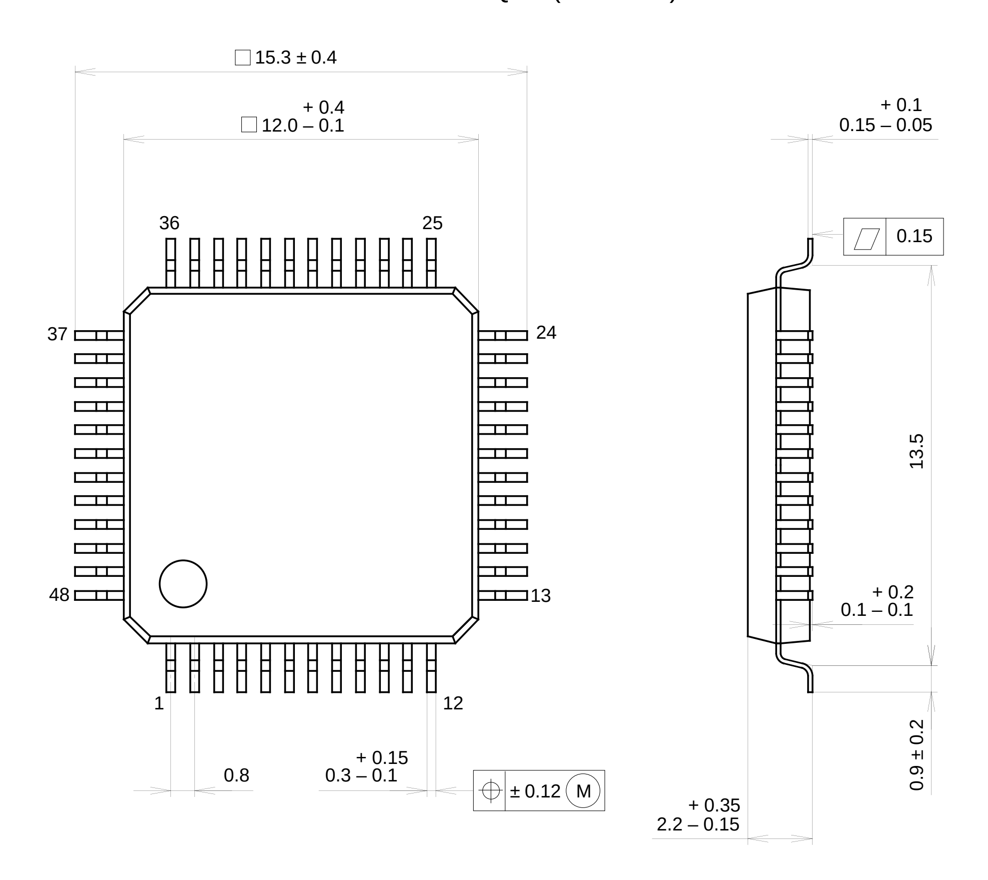
The internal circuit of VCT pin has the following structure.
Insert a buffer when using it as a reference voltage for an external circuit.



Package Outline Unit: mm

CXA1646Q

48PIN QFP (PLASTIC)



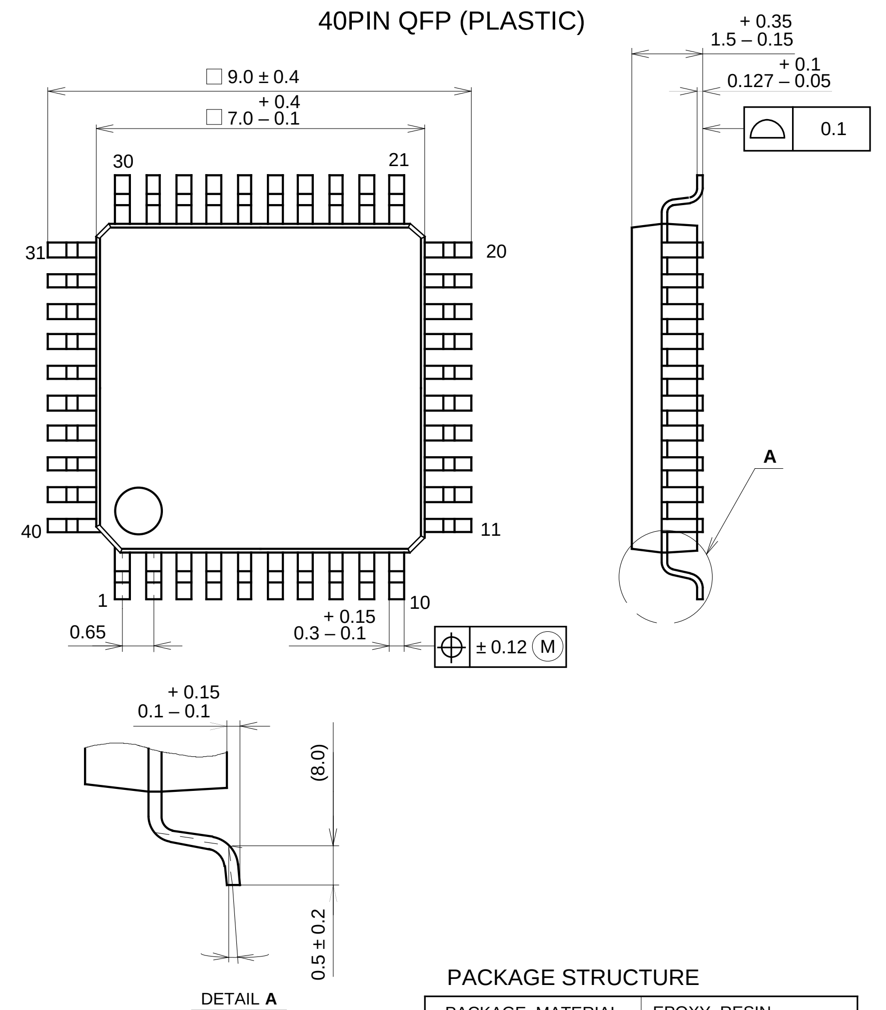
PACKAGE STRUCTURE

SONY CODE	QFP-48P-L04
EIAJ CODE	*QFP048-P-1212-B
JEDEC CODE	————

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER / PALLADIUM PLATING
LEAD MATERIAL	COPPER / 42 ALLOY
PACKAGE WEIGHT	0.7g

NOTE : PALLADIUM PLATING
This product uses S-PdPPF (Sony Spec.-Palladium Pre-Plated Lead Frame).

CXA1767Q



SONY CODE	QFP-40P-L01
EIAJ CODE	*QFP040-P-0707
JEDEC CODE	————

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER / PALLADIUM PLATING
LEAD MATERIAL	COPPER / 42 ALLOY
PACKAGE WEIGHT	0.2g